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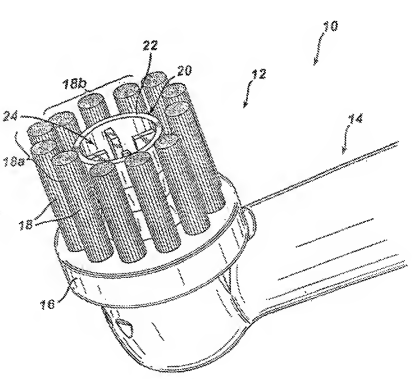

(57) Abstract: Toothbrush heads, e.g., for power toothbrushes, are provided. The toothbrush heads include a support member, a resilient member extending from the support member, and a plurality of tufts of bristles extending from the support member and at least partially surrounding the resilient member. The resilient member may be cup-shaped, fan-shaped, or textured

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TOOTHBRUSHES

This invention relates to toothbrushes, and more particularly to power toothbrushes.

Power toothbrushes are well known and have been on the market for years. In typical power toothbrushes, tufts of bristles on the brush head extend generally perpendicularly from the top surface of the head. The head is oscillated, rotated and/or translated in order to provide enhanced tooth cleaning capability.

In one aspect, the invention features a toothbrush head that includes a support member, a resilient member extending from the support member, and a plurality of bristles or tufts of bristles extending from the support member and at least partially surrounding the resilient member. By "resilient member" we mean a unitary structure formed of a resilient material such as an elastomer or foam, the resilient member having a perimeter, when the resilient member is viewed from above (e.g., looking down the long axis of the bristles, if the bristles and resilient member are disposed perpendicular to the support member), which circumscribes an area greater than the surface area of the resilient member that will initially contact the teeth of a user of the toothbrush. By "initially contact the teeth", we mean the surface area that will contact the teeth and/or gums prior to any significant deformation of the resilient member resulting from the application of pressure against the teeth, i.e., the area that would contact the teeth if the toothbrush were lightly touched to the teeth with the power turned off. By "unitary structure", we mean that, if the resilient member includes a plurality of elements, such as fins, protrusions or lammelae, the elements are integrally joined to form a single structure that is mounted on the separate support member.

In one aspect, the resilient member may be cup-shaped.

The term "cup-shaped", as used herein, refers to a shape that is generally elliptical, oval, ovoid, or circular in cross-section and that defines a central open area. The walls of the cup-shaped member may be continuous or discontinuous and may define a cylinder, cone, frustroconical shape, or other desired shape. The bottom of the central open area may be flat, concave, or any other desired shape.

In another aspect, the resilient member may be fan-shaped.

The term "fan-shaped", as used herein, refers to a shape that is generally comprised of a central hub region and at least two protrusions, e.g., ribs, fins, or other types of protrusions, that extend substantially radially from the central hub region. The protrusions may form a helix, spiral, screw, or other pattern. The central hub region may be solid, hollow, or cup-shaped, and may be, for example, generally elliptical, oval, ovoid, or circular in cross-section.

In a third aspect, the resilient member is "textured".

The term "textured", as used herein, refers to a structure that has a macroscopic surface texture. For example, the textured member may be composed of a cluster of ribs, fins, columns, or other protrusions, or a combination of ribs, fins, columns, or other protrusions, that together form a unitary structure. As other examples, the texture can be imparted to the member by a manufacturing process such as injection molding, by embedding particles in the surface of the member, or by selecting a material for the member that inherently has a surface texture, e.g., an open cell foam.

Some implementations include one or more of the following features. The toothbrush head is configured for use on a power toothbrush. The cup-shaped, fan-shaped or textured member comprises a resilient material.

The cup-shaped member defines an open central area having a depth of from about 2 to 5 mm. The cup-shaped member includes a side wall that is substantially continuous. The cup-shaped member includes a plurality of segments that define a discontinuous side wall. The cup-shaped member includes a generally cylindrical, conical or frustroconical side wall.

The toothbrush head further includes a plurality of fin members extending inwardly from an inner surface of the cup-shaped member. The fins have different lengths, heights, and/or thicknesses. At least some of the fin members converge to intersect at a central hub. The central hub has a shape selected from the group consisting of cones, inverted cones, cups and cylinders. The converging fin members increase in height with increasing radial distance from the central hub. The cup-shaped member includes a wavy edge.

The toothbrush head further includes one or more inner cup-shaped

members disposed concentrically within an open area defined by the cup-shaped member. The cup-shaped member and inner cup-shaped members are comprised of segments that define discontinuous outer walls of the cup-shaped members.

At least some of the tufts have different heights. The height of the bristle tufts is greater than the height of the cup-shaped member.

The fan-shaped member includes a plurality of protrusions extending radially from a central hub. The central hub is generally cylindrical or conical.

The textured member includes a plurality of lammelae extending from a common base. The textured member includes a molded element having an integrally molded surface texture. The textured member comprises a resilient member formed of a material having a macroscopic surface texture.

The invention also features methods of using and making the toothbrush heads described above.

In some implementations, the toothbrush head provides gum massaging and stimulation in addition to cleaning. The cup-shaped member may help position the toothbrush head on each individual tooth during brushing. This positioning of the head may in turn assist the user in obtaining a proper tooth-to-tooth brushing technique, rather than using a scrubbing motion. This seating action also helps to position the bristles surrounding the cup-shaped member to more effectively access areas between the teeth and along the gumline. In addition, the cup-shaped member may help hold the toothpaste against the teeth during brushing. As a result, toothbrushing may be less messy, and the toothbrush head may be able to hold more toothpaste. Also, toothpaste may tend to be concentrated against the tooth surface, which may in turn result in improved whitening, stain removal, and cleaning. The cup-shaped member may also enhance plaque removal. In some embodiments, the cup-shaped member may be designed to enhance the foaming action of toothpaste.

In other implementations, the toothbrush head may provide enhanced surface cleaning by the motion of the fan-shaped or textured member, both of which provide a wiping action. The increased contact area of the member with the surface of the tooth may also provide enhanced whitening and stain removal.

Other features and advantages of the invention will be apparent from

the description and drawings, and from the claims.

DESCRIPTION OF DRAWINGS

Fig. 1 is a perspective view of a portion of a power toothbrush, according to a first embodiment of the invention.

Fig. 1A is similar to Fig. 1, with the front tufts of bristles removed to show the detail of the cup-shaped member.

Fig. 1B is a side view of Fig. 1A.

Figs. 2 is a perspective view of a toothbrush head according to an alternative embodiment of the invention. Fig. 2A is a side view of a toothbrush head similar to the one shown in Fig. 2 with the front tufts of bristles removed to show the detail of the cup-shaped member. Fig. 2B is a cross-sectional view of the toothbrush head shown in Fig. 2, taken along the long axis of the toothbrush.

Figs. 3-10 are perspective views of toothbrush heads according to various alternative embodiments of the invention, with the exception of Fig. 7A, which shows the toothbrush head shown in Fig. 7 with the front tufts of bristles removed to show the detail of the fan-shaped member.

Referring to Fig. 1, a power toothbrush 10 includes a head 12 and a neck 14. As is well known to those skilled in the art, head 12 is oscillated during brushing. An electric motor (not shown) oscillates the head through gearing, linkages, cranks, and/or other drive mechanisms as is well known. Electrical power may be supplied to the motor by rechargeable or single use (disposable) batteries. Further details as to how the head is oscillated will not be provided, as this aspect of the brush is not the focus of the invention.

Head 12 includes a generally circular support member 16, and, extending from the support member 16, a plurality of bristle tufts 18. Although each tuft is shown as a solid mass in the drawings, the tufts are actually each made up of a great mass of individual plastic bristles. The bristles may be made of any desired polymer, e.g., nylon 6.12 or 6.10, and may have any desired diameter, e.g., 4-8 mil. The tufts are supported at their bases by the support member, and may be held in place by any desired tufting technique as is well known in the art, e.g., hot tufting or a stapling process. The tufts may also be mounted to move on the support member, as is

well known in the toothbrush art.

Head 12 further includes a cup-shaped member 20, which can be seen clearly in Fig. 1A, in which some of the bristle tufts have been omitted. Cup-shaped member 20 includes a side wall 22 that defines a central open area 24. Generally, the central open area 24 has a depth of from about 2 to 5 mm, measured from the highest point of the rim of the cup-shaped member to the lowest point of the central open area. Cup-shaped member 20 also includes a plurality of ribs 26 that extend inwardly into the open area 24. The cup-shaped member 20 is preferably formed of a resilient material such as an elastomer, e.g., a thermoplastic elastomer. The material hardness for such structures may range from 10 to 70 Shore A, with the preferred hardness selection depending on the design and dimensions of the cup-shaped member.

The cup-shaped member 20 may be fixedly mounted on the toothbrush head, or may be rotatably mounted, so that the cup-shaped member 20 can spin about its long axis while the toothbrush head is oscillated. The spinning motion may be driven by the same motor that oscillates the head, as would be understood by those skilled in the art. If the cup-shaped member is fixedly mounted, it may be mounted by any conventional technique, e.g., by screwing it in place or over-molding it onto the support member.

As shown in Fig. 1B, the height of bristle tufts 18 above the top surface S of support member 16 will generally be greater than the height of the cup-shaped member 20 from surface S. This height differential allows the head to contour around each tooth, enhancing the tooth-to-tooth indexing effect mentioned above.

There is also a height differential between the different bristle tufts. The end bristle tufts 18A, i.e., the tufts that are adjacent the long axis of the toothbrush neck 14 when the head 12 is at rest, are taller than the side tufts 18b. For example, the height of the cup-shaped member may be from about 5.5 to 10 mm, with the end tufts 18A being about 20 to 30% taller than the cup-shaped member, e.g., from about 6.6 to 13 mm in height, and the side tufts 18b being about 5 to 15% taller than the cup-shaped member, e.g., about 5.8 to 11.5 mm in height. Making the side tufts shorter than the end tufts allows the longer tufts to reach in between the teeth, while the shorter tufts clean along the gumline.

Toothbrush heads according to other embodiments are shown in Figs. 2-10. In each of these embodiments, the support members 116 are generally elliptical, rather than circular as shown in Fig. 1. The elliptical shape provides more room for additional bristle tufts, and thus these toothbrush heads further include curved, elongated interdental tufts 28. In these embodiments, the cup-shaped member and bristle tufts are generally shorter than in the embodiment discussed above. In an elliptical head, the reduced height will tend to make the brush more comfortable and less "bulky" feeling in a user's mouth. As in the embodiment discussed above, the bristle tufts are generally taller than the cup-shaped member. As shown in Fig. 2A, the interdental tufts 28 are also taller than the cup-shaped member, e.g., by about 30 to 40%.

Each of the embodiments shown in Figs. 2-7 includes a different type of cup-shaped member.

In head 112, shown in Fig. 2, cup shaped member 120 includes a side wall 122, and extending inwardly from the side wall, a plurality of ribs 30 that converge at a generally cylindrical central hub 32. In alternate embodiments (not shown) the central hub may be conical or cup-shaped. In this design, as shown in Fig. 2B, the ribs are at the same height as the cup at the outer perimeter, and decrease in height as they approach the center. This arrangement allows the ribs to act as "squeegees" to clean the tooth surface. The addition of the central hub adds strength to the total structure and the ribs. If this additional strength is not required for a particular design, the central hub may be omitted, and the ribs may simply intersect each other, or may stop short of intersecting. In head 212, shown in Fig. 3, cup-shaped member 220 includes a side wall 222 and, extending inwardly from the side wall, a plurality of larger ribs 34 and smaller ribs 36. The larger ribs are longer (i.e., extend further into the center), and may have a different thickness and/or height than the smaller ribs.

In the embodiments shown in Figs. 4 and 5, the cup-shaped member is segmented, i.e., it has a discontinuous side wall that includes a plurality of arcuate segments. The segmented structure imparts flexibility to the cup-shaped member, and may allow the cup-shaped member to conform better to the tooth surface. As can be seen in Fig. 5, in these embodiments the segments are defined by grooves 42 that do

not extend to the bottom of the cup-shaped member. As a result, the segments are connected to form a unitary structure.

In head 312, shown in Fig. 4, cup-shaped member 320 includes a segmented side wall that includes four arcuate segments 40 having grooves 42 therebetween. Within the open center area defined by the cup-shaped member 320 are disposed two concentrically arranged smaller inner cup-shaped members 44 and 46. These inner cup-shaped members have the same segmented structure as the outer cup-shaped member 320. The concentric members provide a large surface area for contact with the tooth surface, which may provide improved cleaning.

In head 412, shown in Fig. 5, cup-shaped member 420 again includes a segmented side wall comprised of four arcuate segments. In this embodiment, ribs 126 extend inwardly from the side wall, as in the embodiment shown in Fig. 1.

In the embodiment shown in Fig. 6, head 612 includes a cup-shaped member 620 that has a wavy fringe 54 extending above its upper edge 56. The wavy fringe is relatively soft and flexible, so that it will lay flat when pressed against the surface of the teeth. This may allow the fringe to slide under the gums and between the teeth, providing plaque removal and gum stimulation which may reduce gingivitis. Generally, the fringe has a thickness of about 0.15 to 0.25 mm, measured at its top edge, and about 0.4 to 0.8 mm measured at its base (where the fringe joins the rim of the cup-shaped member). While four relatively large waves are shown in Fig. 6, if desired more waves and/or smaller waves may be used. The number and size of the waves are selected to provide desired product attributes.

Head 612 also differs from the designs described above in that the cup-shaped member 620 includes ribs 60 that are inclined with respect to the longitudinal axis of the cup-shaped member.

In the embodiment shown in Fig. 7, head 512 includes a fan-shaped member 520 that has a plurality of ribs 50 extending radially from an outer surface of its side wall 52 in a fan-like arrangement. In this embodiment, the side wall 52 is generally conical. Alternatively, if desired, the side wall may be cylindrical (not shown). In this embodiment, the fan-like structure of the cup-shaped member may enhance the foaming action of some toothpastes. The ribs may also act as "squeegees",

enhancing tooth-cleaning action.

In the embodiment shown in Fig. 8, head 712 includes a textured member 720 that is comprised of a plurality of lammelae 722 that extend from a common base 724 together define a unitary structure. The lammelae 722 are arranged in different directions to give a "textured" feel. In this embodiment, the lammelae define a generally circular member, and are arranged in groups that are at right angles to each other in a "woven" pattern. However, the textured member may have any desired shape and arrangement of lamellae. It is generally preferred that the lammelae be relatively closely spaced, e.g., that spaces 726 be less than about 0.75 mm wide, more preferably about 0.5 mm or less.

In the embodiment shown in Fig. 9, head 812 includes a textured member 820. Textured member 820 includes a generally cylindrical base 822 and, extending from the base, a contact portion 824 that includes a central hub 826 and a plurality of ribs 828 extending radially from the hub. Textured member 820 may be formed of a foam, as shown, to provide a surface texture.

In the embodiment shown in Fig. 10, head 912 includes a textured member 920, including a generally cylindrical base 922 and, extending from the base, a plurality of small nubs 924 that provide the member with a textured feel.

A textured feel may be provided in many ways, for example by forming a resilient member of any desired shape of a material having a macroscopic surface texture, e.g., an open celled foam, or a material having texture-imparting particles embedded in its surface.

Other embodiments are within the scope of the following claims.

For example, while the cup-shaped member is shown in the drawings as centrally-located on the toothbrush head, if desired it may be positioned off-center.

Moreover, while various embodiments are shown in the drawings and described above, many other types of cup-shaped members may be used, as will be well understood by those skilled in the art. For example, the side wall of the cup-shaped member may have a tapered outer surface, or may be straight sided or have any other desired design.

Additionally, which the cup-shaped member is described above as

being surrounded on all sides by bristle tufts, if desired the cup-shaped member may be only partially surrounded by bristle tufts. For example, if desired the side tufts 18B in Figs. 1 could be omitted.

Moreover, while heads for power toothbrushes have been described above, resilient members having the features described above may be used on manual toothbrushes, if desired.

CLAIMS

1. A head for a toothbrush comprising:

a support member,

a resilient member extending from the support member, and

a plurality of tufts of bristles extending from the support member and at least partially surrounding the resilient member.

2. The toothbrush head of claim 1, wherein the resilient member comprises a cup-shaped member.

3. The toothbrush head of claim 1, wherein the resilient member comprises a fan-shaped member.

4. The toothbrush head of claim 1, wherein the resilient member comprises a textured member.

5. The toothbrush head of claim 1, wherein the head is configured for use on a power toothbrush.

6. The toothbrush head of claim 2, wherein the cup-shaped member comprises a resilient material.

7. The toothbrush head of claim 2, wherein the cup-shaped member includes a side wall that is substantially continuous.

8. The toothbrush head of claim 2, wherein the cup-shaped member includes a plurality of segments that define a discontinuous side wall.

9. The toothbrush head of claim 2, wherein the cup-shaped member includes a generally cylindrical side wall.

10. The toothbrush head of claim 2, wherein the cup-shaped member includes a generally conical or frustroconical side wall.

11. The toothbrush head of claim 2, further including a plurality of fin members extending inwardly from an inner surface of the cup-shaped member.

12. The toothbrush head of claim 1, wherein the resilient member includes a wavy edge.

13. The toothbrush head of claim 1, further including one or more inner cup-shaped members disposed concentrically within an open area defined by the resilient member.

14. The toothbrush head of claim 13, wherein the resilient member and inner cup-shaped members are comprised of segments that define discontinuous outer walls of the cup-shaped members.

15. The toothbrush head of claim 11, wherein at least some of the fin members converge to intersect at a central hub.

16. The toothbrush head of claim 15, wherein the central hub has a shape selected from the group consisting of cones, inverted cones, cups and cylinders.

17. The toothbrush head of claim 15, wherein the converging fin members increase in height with increasing radial distance from the central hub.

18. The toothbrush head of claim 11, wherein the fins have different lengths.

19. The toothbrush head of claim 11, wherein the fins have different thicknesses.

20. The toothbrush head of claim 11, wherein the fins have different heights.

21. The toothbrush head of claim 2, wherein the cup-shaped member defines an open central area having a depth of from about 2 to 5 mm.

22. The toothbrush head of claim 1, wherein at least some of the tufts have different heights.

23. The toothbrush head of claim 1, wherein the height of the bristle tufts is greater than the height of the resilient member.

24. The toothbrush head of claim 3, wherein the fan-shaped member includes a plurality of protrusions extending radially from a central hub.

25. The toothbrush head of claim 24, wherein the central hub is generally conical, cylindrical or cup-shaped.

26. The toothbrush head of claim 3, wherein the height of the bristle tufts is greater than the height of the fan-shaped member.

27. The toothbrush head of claim 4, wherein the textured member includes a plurality of individual elements extending from a common base.

28. The toothbrush head of claim 27, wherein said elements comprise protrusions selected from the group consisting of lamnellae, nubs, and combinations

thereof.

29. The toothbrush head of claim 4, wherein the textured member includes a molded element having an integrally molded surface texture.

30. The toothbrush head of claim 4, wherein the textured member comprises a resilient member formed of a material having a macroscopic surface texture.

31. The toothbrush head of claim 4, wherein the textured member comprises a resilient material.

32. The toothbrush head of claim 4, wherein the height of the bristle tufts is greater than the height of the textured member.

33. The toothbrush head of claim 1, wherein the resilient member comprises a material having texture-imparting particles embedded in its surface.

34. A head for a toothbrush comprising:

a support member,

a resilient member extending from the support member, the resilient member being selected from the group consisting of cup-shaped members, fan-shaped members, and textured members, and

a plurality of tufts of bristles extending from the support member and at least partially surrounding the resilient member.

35. A head for a toothbrush comprising:

a support member,

a resilient member extending from the support member, and

a plurality of tufts of bristles extending from the support member and at least partially surrounding the resilient member;

the head being configured for use on a power toothbrush.

FIG. 1

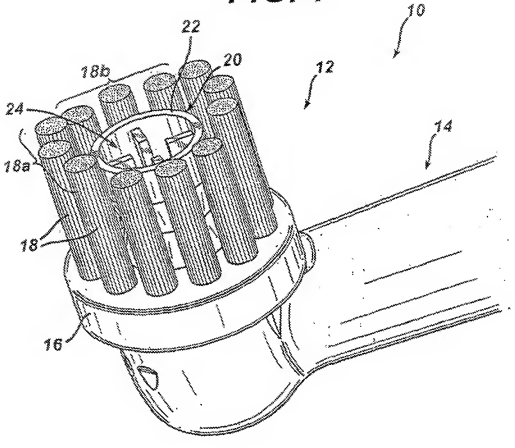


FIG. 1A

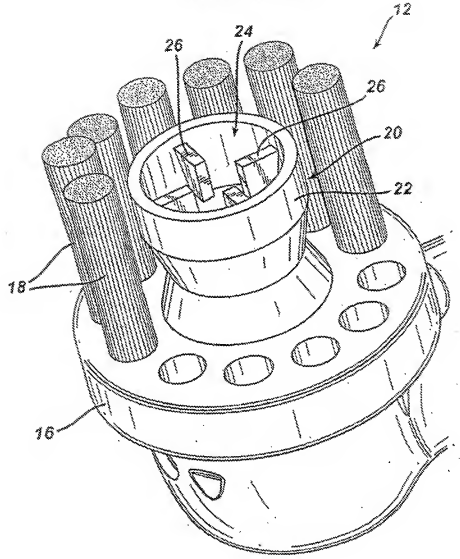


FIG. 1B

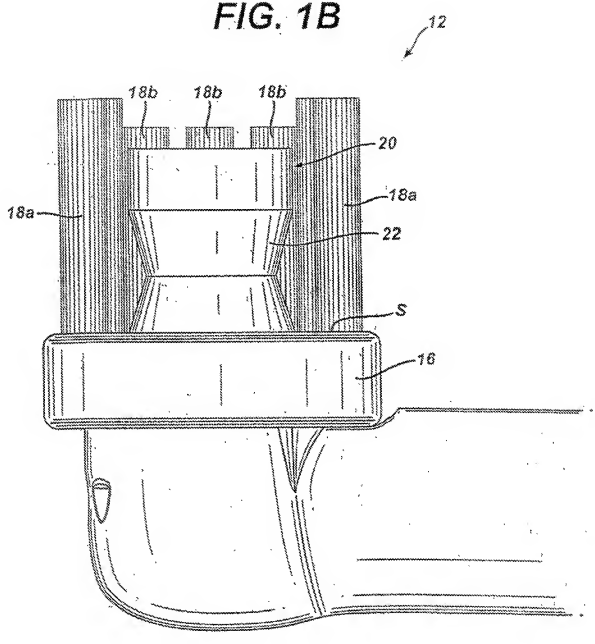
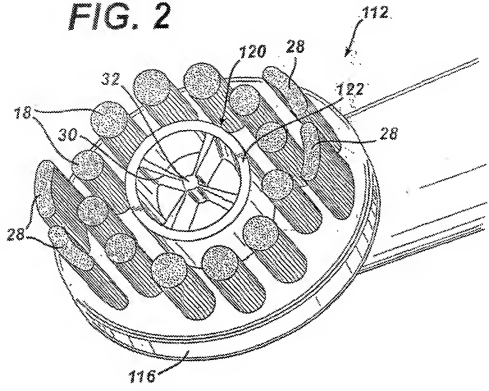


FIG. 2



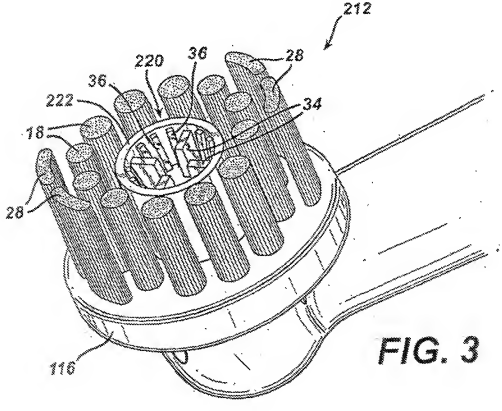


FIG. 3

FIG. 2A

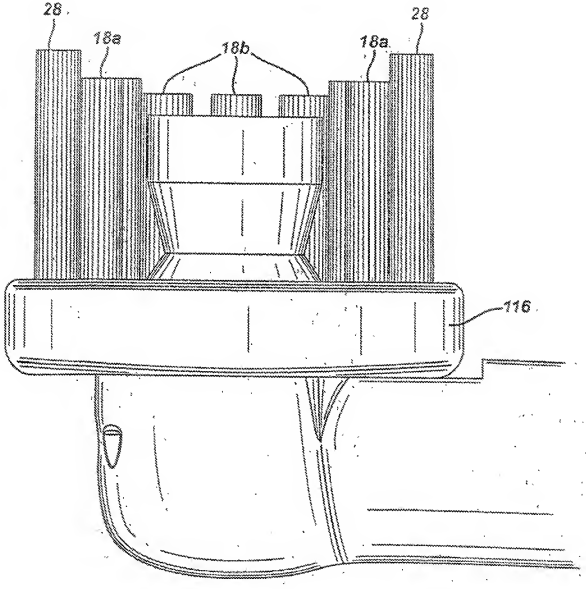
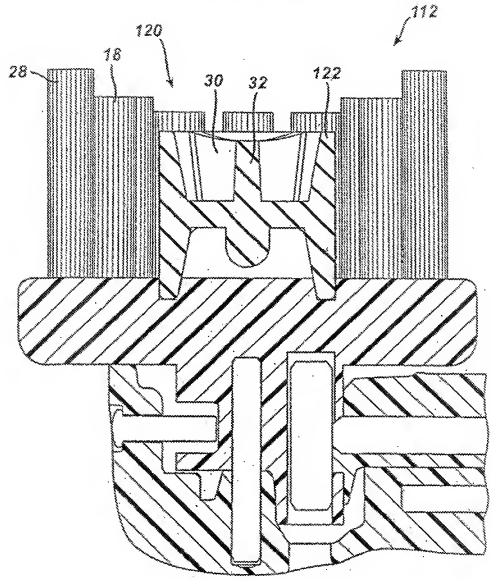


FIG. 2B



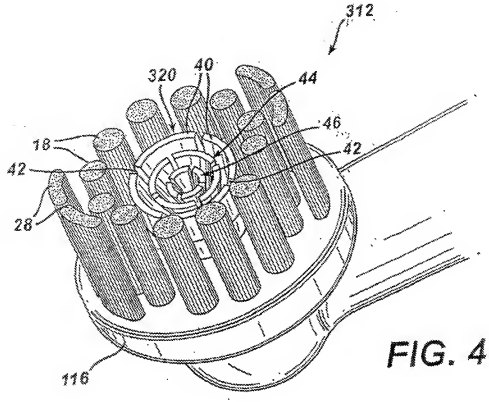


FIG. 4

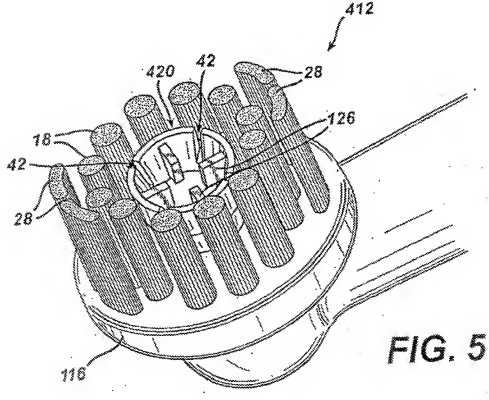


FIG. 5

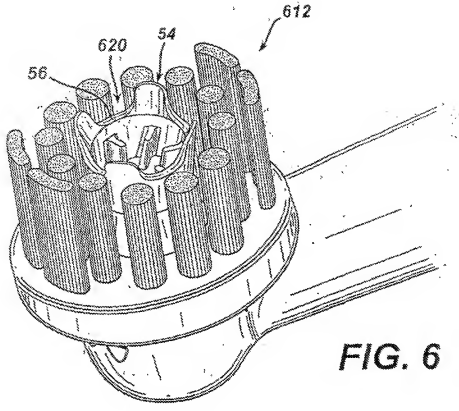


FIG. 6

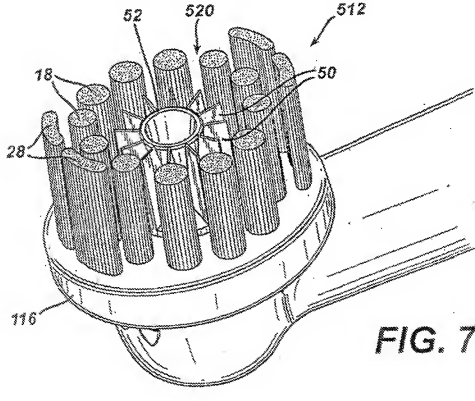


FIG. 7

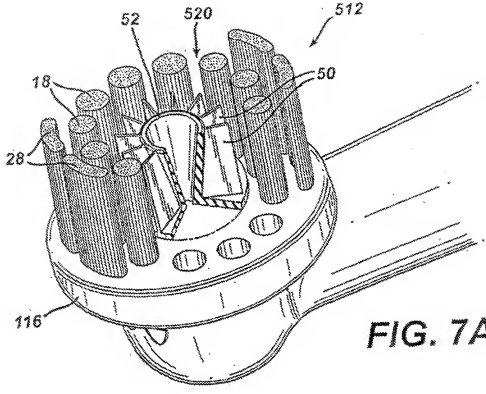
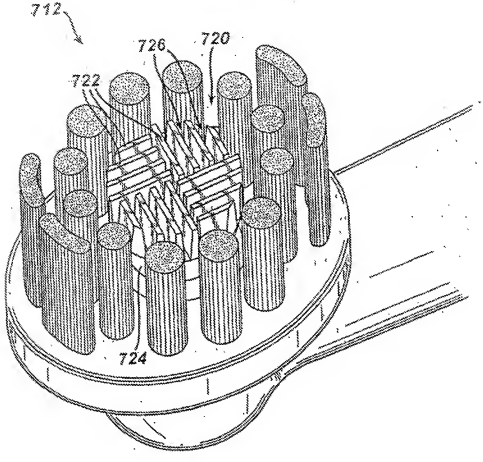


FIG. 7A

FIG. 8



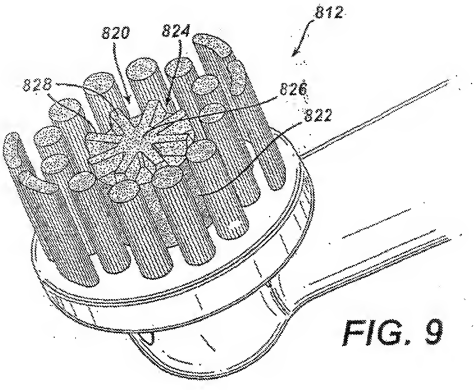


FIG. 9

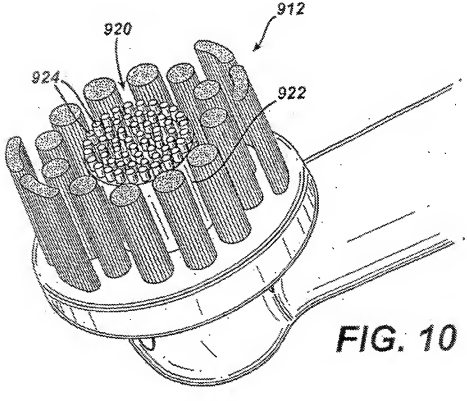


FIG. 10

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2004/002401

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A46B15/00 A61C17/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A46B A61C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 389 634 B1 (ROBERTS MICHAEL F ET AL) 21 May 2002 (2002-05-21) column 5, line 62 -column 6, line 57; figures 7-15 column 4, line 50 -column 5, line 9	1,3, 22-26,34
X	WO 02/11583 A (GILLETTE CANADA COMPANY ;BREDALL WILLIAM A (US); BRAUN PHILLIP M () 14 February 2002 (2002-02-14) page 5, line 13 - line 25 page 7, line 32 -page 8, line 26	1,4, 27-31, 33,34
X	US 5 735 011 A (ASHER RANDALL S) 7 April 1998 (1998-04-07) the whole document	1,4,27, 28,30-34

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
23 June 2004	05/07/2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Ardhuin, H

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2 702 914 A (KITTLE LEVI O ET AL) 1 March 1955 (1955-03-01) column 3, line 29 - line 50 column 2, line 41 - line 64	1,22,23
X	US 2 246 867 A (NASH MANLEY K ET AL) 24 June 1941 (1941-06-24) the whole document	1
X	US 3 103 027 A (BIRCH MARJORIE A) 10 September 1963 (1963-09-10) column 1, line 53 -column 2, line 23	1
X	US 6 513 182 B1 (CALABRESE GIUSEPPE ET AL) 4 February 2003 (2003-02-04) column 2, line 1 - line 18; figures 1B-4 column 3, line 19 - line 30	1,12
P,X	WO 03/055351 A (FISCHER FRANZ ;STRAEHLER RETO (CH); TRISA HOLDING AG (CH)) 10 July 2003 (2003-07-10) page 11, line 21 -page 12, line 16; figures 4A-4E,8A-8E page 15, line 10 - line 18	1-35

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US2004/002401

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6389634 B1	21-05-2002	AT 259177 T	15-02-2004
		AU 1618900 A	13-06-2000
		BR 9915580 A	14-08-2001
		CN 1328425 T	26-12-2001
		DE 69914795 D1	18-03-2004
		EP 1133247 A1	19-09-2001
		JP 2003524450 T	19-08-2003
		WO 0030495 A1	02-06-2000
WO 0211583 A	14-02-2002	AU 8109301 A	18-02-2002
		BR 0113080 A	24-06-2003
		CN 1449257 T	15-10-2003
		EP 1320309 A2	25-06-2003
		WO 0211583 A2	14-02-2002
US 5735011 A	07-04-1998	AU 5427698 A	10-06-1998
		WO 9822000 A1	28-05-1998
US 2702914 A	01-03-1955	NONE	
US 2246867 A	24-06-1941	NONE	
US 3103027 A	10-09-1963	NONE	
US 6513182 B1	04-02-2003	AT 247398 T	15-09-2003
		AU 7657000 A	24-04-2001
		BR 0013985 A	14-05-2002
		CN 1374840 T	16-10-2002
		DE 20023178 U1	13-03-2003
		DE 60004684 D1	25-09-2003
		DE 60004684 T2	11-03-2004
		WO 0121036 A1	29-03-2001
		EP 1211963 A1	12-06-2002
		EP 1308108 A1	07-05-2003
		ES 2199866 T3	01-03-2004
		HU 0202869 A2	28-12-2002
		PL 353919 A1	15-12-2003
		TR 200200677 T2	21-06-2002
		US 2002124337 A1	12-09-2002
		ZA 200201269 A	14-02-2003
WO 03055351 A	10-07-2003	DE 10164336 A1	17-07-2003
		WO 03055351 A1	10-07-2003
		US 2003159224 A1	28-08-2003